

HETEROPTERA OVERWINTERING IN MAGNOLIA LEAF LITTER IN PENNSYLVANIA¹

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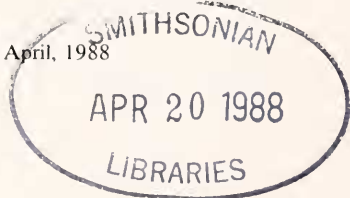
ABSTRACT: Magnolia leaf litter, particularly that of the large-leaved cucumber tree, *Magnolia macrophylla*, offers protection for numerous overwintering arthropods, including adult Heteroptera. In a period spanning the winters of 1984-87, we examined 6 samples of 300-400 longitudinally folded leaves at a nursery in southcentral Pennsylvania. Twenty-five heteropteran species, representing 9 families and 190 individuals (including 13 dead specimens), were collected. Families yielding the largest number of species were the Lygaeidae (7) and Pentatomidae (6); species represented by the largest number of specimens were the tarnished plant bug, *Lygus lineolaris* (Palisot) (43 live individuals), and the nabid *Nabis roseipennis* Reuter (41). All species and number of individuals observed are given in a table, and species previously recorded to overwinter in leaf litter are noted.

Overwintering stages of many common North American Heteroptera have been determined. For species hibernating in the adult stage, individuals may merely be reported to choose "protected places." But records of more specific sites—in grass clumps, beneath bark, under logs or rocks, or in fallen leaves—are numerous in the literature, though sometimes based on single observations. Such information has accumulated from general studies on arthropod hibernation (e.g. Holmquist, 1926; Dowdy, 1955); winter collecting of Heteroptera in particular regions, e.g. western Indiana (Blatchley, 1895), Los Angeles, California (Blatchley, 1934), and northern Arkansas (Isaza-Restrepo, 1958); observations of microhabitats, e.g., mullein rosettes (McAtee, 1924), dry trees (Dennys, 1927), and Spanish moss (Rainwater, 1941); and studies on particular species, e.g., the tarnished plant bug, *Lygus lineolaris* (Palisot) (Painter, 1929). In addition, Jones and Sullivan (1981) reported on habitat preferences, spring emergence, and winter mortality of 47 species of Heteroptera in South Carolina, and Schowalter (1986) studied overwintering site selection and aggregation in the western boxelder bug, *Boisea rubrolineata* (Barber).

Holmquist (1926) remarked that fallen leaves offer excellent protection for arthropod hibernation. A Pennsylvania nursery in which several large-leaved magnolias are grown provided an opportunity to study the heteropteran fauna using fallen, often longitudinally folded leaves as overwintering sites. Here we record species taken on 6 sample dates during 3 winters and give notes on their abundance and behavior.

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METHODS AND STUDY SITE

Collections were made in a nursery at Manchester (York Co.) in south-central Pennsylvania on 20 Dec. 1984, 7 and 27 Mar. 1985, 5 Mar. and 19 Nov. 1986, and 12 Mar. 1987. On each sample date we examined 300-400 fallen magnolia leaves, mostly those of a large-leaved cucumber tree, *Magnolia macrophylla* Michx., a species endemic from Kentucky to Florida and west to Arkansas and Louisiana. This tall shrub or broad-headed tree has the largest leaves (Fig. 1) of any native tree hardy in North America: 9 dm or nearly 1 m (3 ft) long (Britton, 1908; Everett, 1981). A few fallen leaves were also examined from a row of magnolias that included umbrella tree, *M. tripetala* L. (Fig. 2), in addition to *M. macrophylla*. The largest leaves of umbrella tree are about 7 dm (2 ft) long (Britton, 1908).

Sampling consisted of opening dead leaves folded in half along the midrib (Fig. 1) or having at least a portion overlapping. Repeat sampling of the same leaves was minimized by working in slightly different areas beneath the large *M. macrophylla* used for the majority of the survey. Heteroptera that could be identified with certainty in the field were recorded and released; others were collected and determined in the laboratory.



Figs. 1-2. Magnolia leaf litter in Pennsylvania. 1. Open and folded dead leaves of *Magnolia macrophylla*; 2. fallen leaves of *M. tripetala*.

Numbers of each species (alive or dead) were recorded, except on the first collection date when the number of individuals was only approximated. Voucher specimens have been deposited in the insect collection of the Pennsylvania Department of Agriculture.

RESULTS AND DISCUSSION

Twenty-five species in nine heteropteran families were found overwintering in magnolia leaf litter (Table 1). The majority of the approximately 190 individuals observed (13 were dead) were present in longitudinally folded leaves rather than between layers of leaves.

All species in our samples were adults except for the reduviid *Zelus* sp., which was collected as fifth-instar nymphs. All individuals were observed in recently fallen (previous summer's) leaves except for *Acrosternum hilare* (Say); 2 adults of this pentatomid were taken in a folded, partially decomposed leaf of a previous season. The only other species not collected singly in folded leaves were *Lygus lineolaris* (occasionally 2/leaf were observed) and the lygaeid *Drymus unus* (Say), which once was found coupled end to end in a copulatory position. Sweet (1964) determined in the laboratory that this cold-adapted lygaeid may oviposit at temperatures as low as 5°C. Species collected singly in folded leaves often were observed with individuals of other arthropod groups (particularly spiders and beetles).

Families represented by the largest number of species were the Lygaeidae (7) and Pentatomidae (6), though only 18 individuals of the latter were observed (Table 1). Only one member of the largest heteropteran family, the Miridae, was found. A high percentage of mirids inhabiting temperate regions are univoltine and overwinter as diapausing eggs (e.g., Knight, 1941; Kullenberg, 1944; Cobben, 1968).

Most species collected in the study were represented only by a few specimens. Nine were taken only on one sample date, and only one individual of 8 species was collected. No species was observed on all 6 dates, but *L. lineolaris* and the nabids *Hoplistoscelis sordidus* (Reuter) and *Nabis roseipennis* Reuter were taken on all but one date. Two of these species, *L. lineolaris* (43 live individuals) and *N. roseipennis* (41), yielded the largest number of specimens (Table 1).

Several of the species encountered have been recorded to hibernate in leaf litter. Among them are the berytids *Jalysus spinosus* (Say) (Froeschner, 1942) and *Neides muticus* (Say) (Holmquist, 1926); the lygaeid *Myodocha serripes* Olivier (Blatchley, 1895); *Lygus lineolaris* (Crosby and Leonard, 1914; Holmquist, 1926; Blake, 1927; Painter, 1929); the nabid *Hoplistoscelis sordidus* (Harris, 1928); the pentatomids *Acrosternum hilare*

(Whitmarsh, 1917; Underhill, 1934), *Banasa dimidiata* (Say) (Stoner, 1916), *Euschistus tristigma* (Say) (Jones and Sullivan, 1981), *E. variolarius* (Palisot) (Holmquist, 1926; Froeschner, 1941), and *Holcostethus limbolarius* (Stal) (Stoner, 1920); and the rhopalid *Arhyssus lateralis* (Say) (Blatchley, 1926). Several other species taken in our study have been collected during winter beneath the woolly leaves of common mullein, *Verbascum thapsus* (L.) (e.g. Blatchley, 1895, 1926; McAtee, 1924; Froeschner, 1944).

In New England, Sweet (1964) found that *Drymus unus* overwinters in the egg stage and suggested that this lygaeid's late oviposition habits and cold hardiness explain records of supposed hibernating adults. He noted that all such records were for late November or December. But the presence in our study of an adult on 20 Dec. 1984, 2 on 5 Mar. 1986, and 1 on 12 Mar. 1987 indicates that some adults overwinter in southcentral Pennsylvania. Two of the 6 individuals we observed were dead (Table 1), possibly suggesting a high winter mortality.

When disturbed, individuals of most species were not completely dormant and moved slowly within folded leaves. On warm days in winter some Heteroptera undoubtedly move within the leaf litter or emerge from hibernation quarters; on 27 March 1985 when the ambient temperature was about 20°C, several tarnished plant bugs were observed in flight. In Illinois, Blake (1927) noted that numbers of this species occurring in the leaf stratum during winter fluctuated widely from week to week. Some individuals of the various Heteroptera observed in magnolia leaf litter may move deeper into the layer of leaves or into the soil with the onset of colder temperatures. Dead individuals of 7 species (including *D. unus* discussed above) were observed, suggesting a winter-induced mortality. For example, 3 of 4 *Arhyssus lateralis* collected on 7 Mar. 1985 were dead; on 12 Mar. 1987 all 3 *Nabis roseipennis* observed were dead, as were 2 of 3 *Acrosternum hilare* (Table 1).

Total number of insects captured on various sample dates varied significantly, undoubtedly the result of many factors. Fluctuating temperatures may have affected the number of insects found while sampling. As the leaf litter warms on mild winter days, some insects are known to come out of their dormant condition and leave their protective sites (Holmquist, 1926), making fewer specimens available for collection. In our study, populations of spiders in the leaf litter were relatively high, and even on the coldest sampling days the spiders were relatively active. Indeed, studies have shown that spiders are affected less by cold than most insects (Dowdy, 1955). Perhaps spider predation plays a role in diminishing overwintering populations of insects. Other predators, such as certain carabids and staphylinids, were found during our study and could also have affected the

Table 1. Numbers of Heteroptera overwintering in magnolia leaf litter; numbers in parentheses indicate dead individuals.

Taxa	Collection Dates and No. of Individuals					
	20-XII-84	7-III-85	27-III-85	5-III-86	19-XI-86	12-III-87
Berytidae						
<i>Jalysus spinosus</i> (Say)	0	0	0	1	2	0
<i>J. wickhami</i> Van Duzee	6	2	1	0	0	0
<i>Neides muticus</i> (Say)	0	1	1	0	0	0
Coreidae						
<i>Leptoglossus fulvicornis</i> (Westwood)	0	0	0	0	1	0
Lygaeidae						
<i>Drymus unus</i> (Say)	1	(1)	0	2	0	1 (1)
<i>Geocoris uliginosus</i> (Say)	1	0	0	1	0	0
<i>Heraeus plebejus</i> Stal	0	(1)	0	1	0	0
<i>Kleidocerys resedae</i> (Panzer)	0	2	0	0	0	0
<i>Myodocha serripes</i> Olivier	3	0	0	1	0	0
<i>Pseudopachybrachius basalis</i> (Dallas)	1	0	0	0	0	0
<i>Scolopostethus thomsoni</i> Reuter	0	0	1	0	0	0
Miridae						
<i>Lygus lineolaris</i> (Palisot)	15	15 (1)	2	10	1	0
Nabidae						
<i>Hoplistoscelis sordidus</i> (Reuter)	8	1	9	4	0	0
<i>Nabis americoferus</i> Carayon	0	0	0	1	1	0
<i>N. roseipennis</i> Reuter	25	9	0	3	4	(3)
Pentatomidae						
<i>Acrosternum hilare</i> (Say)	0	3	1	2	5	1 (2)
<i>Banasa dimidiata</i> (Say)	0	0	1	1	0	0
<i>Euschistus tristigmus</i> (Say)	1	0	0	0	0	0
<i>E. variolarius</i> (Palisot)	0	0	0	0	1	0
<i>Holocostethus limbolarius</i> (Stal)	0	1	0	0	0	0
<i>Thyanta accerra</i> McAtee	1	0	0	0	0	0
Phymatidae						
<i>Phymata pennsylvanica</i> Handlirsch	1	0	0	0	0	0
Reduviidae						
<i>Zelus</i> sp. prob. <i>luridus</i> Stal	0	0	1	2	3	4
Rhopalidae						
<i>Arhyssus lateralis</i> (Say)	3	1 (3)	0	1	0	0
<i>Harmostes reflexulus</i> (Say)	0	1 (1)	0	0	2	0

number of insects overwintering. Patch (1907) observed that in overwintering haunts *Lygus lineolaris* fell prey to ground beetles and rove beetles. Finally, many of the insects that we observed may simply have succumbed to the cold; for *L. lineolaris*, Painter (1929) observed that only 40-60% survived even in the most favorable hibernation sites.

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